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UREDINALES ON CAREX IN NORTH AMERICA

J. C. Arthur

In the systematic work on Uredinales in the North American Flora, a monographic treatise, every entry is based upon a collection in the author's herbarium, either an original one, or some data to represent a collection in another herbarium. Whatever advantage in fundamental accuracy is secured in this work probably depends largely upon the application of four tests which are the foremost guides used in systematically placing every collection: (1) life cycle, so far as direct or collateral evidence can be found; (2) name and systematic position of host; (3) microscopic characters of sorus and spores; (4) the limitation of a species in view of the influence of host and possible occurrence of races.

It has not been many years since most collections of *Carex* rusts were largely labelled "*Puccinia Caricis*" or "*P. caricina*" and said to be on "some species of sedge," or on "*Carex* sp.," and with such material the work on the North American Flora began.

As to the first test to be applied to each collection, regarding the life cycle, *Carex* rusts may be assumed to be uniform in having their spore forms of the general character of those of *Puccinia graminis* and in being heteroecious.

As to the second test, regarding the host, slow but steadily increasing progress has been made in securing authentic determination of the hosts. All *Carex* rusts belong either to the genus *Nigredo* (having 1-celled teliospores) or *Dicaeoma* (having 2-celled teliospores). The material for the species under *Nigredo,* published about a year ago, consisted of 21 collections with leaves and stems only, and 35 other collections accompanied by more or less perfect fruiting parts. The determinations of the latter had been verified or completed by comparison with the author's phanerogamic herbarium, although a few collections had been submitted to experts.

The *Carex* material for the genus *Dicaeoma* is now being studied. A few specimens from time to time have been sent to Dr. Theo. Holm, of Washington, D. C., for critical decision regarding the host. Feeling the great advantage in accuracy that would accrue from having all the material examined and compared under the most favorable conditions, the very generous permission of Dr. Holm to submit the full set to him was accepted, and in June, 1912, all the material being used as the basis for the study of the genus *Dicaeoma,* together with that previously used for the genus *Nigredo,* was sent, to which was added the phanerogamic set of *Carex.*

The phanerogamic collection is used as a basis of comparison, in order to detect any lapses from a probably correct naming of the host. It contains a total of 321 sheets and 133 species, wholly from North America, and includes the Olney and Bailey exsiccatae. Some of the specimens were determined by Wm. Boott and L. H. Bailey, and the Iowa material was once examined by R. I. Cratty. It is gratifying to note that Dr. Holm found occasion to change the names of only five species (nine specimens) of this phanerogamic set, all being changes to closely allied species which some authors consider segregates.

The examination and study of the mycological material was a far greater tax upon Dr. Holm's time and patience, not only because of its fragmentary condition but because the opening of mycological packets in large numbers is burdensome.

Of the material submitted, now being used for the genus *Dicaeoma,* there were 645 packets which contained no fruiting parts of the host, and such names as collectors have attached to them cannot be verified. Of these, however, Dr. Holm questions the correctness of 32, either because of the appearance of the leaves, or because the locality is outside the known range of the species.

Of the 405 packets submitted, which contained some fruiting parts of the host, the larger portion had the specific name of the host attached. From a study of this material Dr. Holm found it necessary to change the names on 29 packets. Out of the 52 packets on which the species of the host had not been given, Dr. Holm was able to supply 34 determinations.

Altogether Dr. Holm examined 1050 packets now being used for the systematic work under the genus *Dicaeoma,* and 56 packets for that previously used under *Nigredo,* or a total of 1106. For this important and authoritative assistance in trying to render the NORTH AMERICAN FLORA as accurate as possible the writer desires to publicly extend to Dr. Holm most hearty thanks.

In the preliminary manuscript for the next rust number of the NORTH AMERICAN FLORA at the present writing (February 1, 1913) there are recognized 24 species of *Dicaeoma* occurring upon 106 species of *Carex.* These 24 species are represented by 1200 North American collections, 150 collections having been added since the material was returned by Dr. Holm in November last. Although this seems like a vast array of material for the rusts on a single genus of hosts, yet one half of the 24 species are represented by 13 or less collections each, and four by only one or two collections each, these four species being from readily accessible localities in Delaware, West Virginia, Wisconsin and South Dakota, except one which is from Guatemala. Some stress should be laid upon this situation as indicating the desirability that collectors search for *Carex* rusts more assiduously, especially for such as appear to be associated in the field with definite heteroecious aecia, and not follow the practice of a famous mycologist of a prominent university who once confessed that he usually threw away *Carex* rusts—they were so troublesome to name.

It is to be hoped that no one will be discouraged by the fact that the chances are not many for picking up one of these rarer species, taking the comparative number of collections under each species as an indication. The three most commonly collected species are one with aecia on *Aster, Solidago, Erigeron* and similar genera, now passing under several names, which is represented by 208 collections, one with aecia on *Urtica* represented by 152 collections, and one with aecia on *Ribes* represented by 146 collections. The remaining seven large species range from 86 to 18 collections each.

As this paper is intended to deal chiefly with the *Carex* hosts, nothing has been said about aecial hosts of the 24 species involved, but incidentally it may be stated that aecia belonging to 11 of these species are known, and are represented by 676 collections at the present time, for which it is hoped to secure equal accuracy in determinations by enlisting the aid of specialists.

So much as to the second test used in the rust work for the NORTH AMERICAN FLORA, the one regarding hosts, and we now turn to the third test, the one relating to microscopic characters of the fungus. It being difficult to carry in mind the minute appearance of the spores for purposes of critical comparison, as many of the collections as possible have been illustrated by camera lucida drawings made with a uniform amplification of 625 diameters. There have been 693 of the *Dicaeoma* collections on *Carex* illustrated in this way, giving 1029 individual teliospores, 937 urediniospores and 69 amphispores; while of their aecial connections 174 collections have been similarly illustrated, showing 135 individual aeciospores and 86 peridial cells, with 17 sections of pycnia more or less completely drawn.

Many of the collections have had sets of data taken regarding length and breadth of a number of spores, usually six to eight, thickness of apex, side wall and pedicel, the color, sculpturing of surface, and number and position of pores. With the *Carex* collections for *Dicaeoma* are 355 such sets of data, and with the associated aecial collections 90 similar sets of data, extended to include peridial cells and pycnia.

Regarding the fourth test applied to each collection, that of the limital characters for the species, nothing need be given in this connection, as the purpose of this article is especially to call attention to the material being used for study. It may be interjected, however, that the term species in the manuscript for the final work is generally made to include such varieties, races or physiological species as many authors prefer to distinguish by separate names.

The presentation of the above statistics will illustrate some features of the method employed in preparing the manuscript for the rust part of the NORTH AMERICAN FLORA, as other collections are treated in essentially the same way as those on *Carex*. It may also indicate to collectors the desirability of including in rust collections such parts of the hosts as best serve to permit of their independent verification or determination. Possibly some idea may be gleaned of the labor and time which such a work entails. As the completeness of the work rests upon the availability of material, it is hoped that in the interests of mycologists in general those who possess either recent or old collections of rusts may contribute duplicate sets when convenient to do so.

PURDUE UNIVERSITY,
LAFAYETTE, IND.